

The sound waves from the fog whistle at Lime Point, however, should have been heard, and as the moderate southwest wind would tend to cause a deflection of the sound wave upward, it is possible that while the sound was inaudible on the deck of the vessel, it might have been heard by a lookout at the masthead.

The catastrophe furnishes a remarkable illustration of the utter helplessness of a vessel in fog despite lights and fog whistles. It would seem that under such conditions nothing short of some method of fog dissipation will suffice.

It has occurred to the writer, although the suggestion may prove of no value in practice, that if a strong sound had been made under water by some automatic contrivance at either Lime Point or Point Diablo, and the *Rio de Janeiro* been provided with some suitable device rendering audible the sound wave through the water, the strong cross current would have facilitated the passage of the sound, and a zone of audibility would have been established in the water while in the atmosphere above the fog signals would have been inaudible.

The accompanying photographs, Plate I, are submitted to show that to a certain degree the captain and the pilot were justified in assuming that they might soon run into areas free from fog. As a matter of fact on the day in question the fog soon disappeared and a delay of perhaps two hours would have prevented the accident. It should not be forgotten, however, that the captain was unwilling to enter the harbor during the fog Thursday night, and that the vessel remained at anchor for a period of nearly twelve hours, and was thereby exposed in a large degree to the danger of collision.

LAKE LADOGA FROM A THERMIC POINT OF VIEW.

By JULES DE SCHOKALSKY, St. Petersburg, Russia. Translated from *Comptes Rendus*, Paris, June, 1900.

Lake Ladoga occupies the first place among the bodies of fresh water in Europe; its surface is thirty-one times larger than that of Lake Lemán; its length is 202 kilometers and its width attains 75 kilometers. Its cartography and hydrography have been studied by a scientific expedition which worked, with interruptions, from 1858 to 1873, under the direction of the Hydrographic Service of the Imperial Russian Navy. The expedition having more especially a hydrographic aim had not time for the study of the chemical composition of the waters of the lake nor for the thermic study of its deep strata layers. The Imperial Russian Geographical Society, at my suggestion, decided to begin these studies and, thanks to the Hydrographic Service and the Ministry of Roads and Communications, who respectively gave the instruments and the use of a small steamer, without which it would have been impossible to carry on the work, I was enabled to make two trips on the lake, both at nearly the same season of the year, during the first half of July, 1897 and 1899.

The temperatures at great depths were measured with the thermometers of Negretti and Zambra, verified as to zero point.

The relief of the bottom of the lake is such that the depth increases regularly from south to north, the greatest depths being found in the northwest portion (120 fathoms = 219 meters). Upon the chart there are two sets of broken lines, one solid, the other in dashes, which show the courses that I sailed. The stations at which the thermometric soundings were made are marked by roman numerals; in 1897 14 were made; 1899, 20; a total of 34, some of which coincide with each other, as will be seen by the chart accompanying this summary.

In 1897 the principal fact that I established was the following: At all of the stations I found that the thermal stratification was *direct*. The temperature of the surface waters and those of the lower strata, at identically the same depths were different at the south and at the north ends of the lake. At the

south end in July the water at the surface was relatively warm, 13.1° C. and 11.3° C., but in proportion as we approached the north the temperature became lower; in the middle of the lake it was 10.7° C. and in the deepest part 6.8° C. At the south, the abyssal strata, in shallow water had quite a high temperature, at 10 meters, 11° C.; at the north, at the IXth station, at 45 fathoms (82 meters), I found a temperature of 4° C., and at the VIIIth station, from 50 fathoms (91 meters) to 120 fathoms (219 meters), or the bottom, the temperature remained nearly constant, 3.9° C.

One might be tempted to think that these temperatures for the surface waters and for the deep strata observed in the month of July, 1897, were already quite low for a season so near to the month of August, in which they reach their maximum for the whole year. But in 1899 I found them still lower, particularly at the northern part of the lake which is the deepest; the two stations marked on the chart show this clearly.¹

But what was especially interesting was the fact that the thermic stratification in July, 1899, at all the deep stations in the north of the lake was distinctly *reversed*, whereas one might have expected that in Ladoga, which according to the classification of Prof. F. A. Forel, belongs to the type of temperate lakes, the inverse stratification would have come to an end at the beginning of summer.

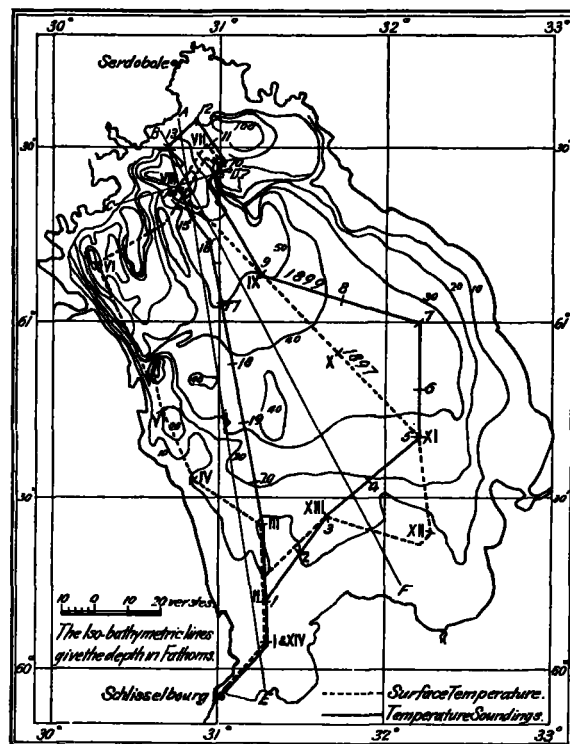


FIG. 10.—Soundings and courses on Lake Ladoga.

The divergences in the results of the two years were caused by the differences in the temperature of the air in the neighboring countries during the springs of 1897 and 1899. If we observe the temperatures of the months of April, May, and June of these two years, and if we compare them with the normals, which are given in the new *Atlas Climatologique de Russie*, published by the Central Physical Observatory, we shall find that the temperature of the air during these three months at seven stations distributed around the lake, was much higher than the normal in 1897 and lower in 1899. According to the *Bulletin Mensuel Météorologique* all the northwest portion of Russia enjoyed temperatures much

¹ The scale of the published chart is too small to show all these stations.—Ed.

higher than the normal in 1897; the deviations in the month of May reached 8° to 11° C. at St. Petersburg; the monthly mean being the highest that had been observed in one hundred and fifty years; it was the same case at Archangel, according to a series of observations for eighty years. On the other hand, the spring and the beginning of the summer of 1899 were, in the northwest portions of Russia, much colder than usual; in the month of May there were days having a deviation of from 5° to 8° C., and the temperature was below the normal during twenty-one consecutive days.

From these results it may be concluded that Lake Ladoga, which undoubtedly belongs to the type of temperate lakes, according to the classification of Prof. F. A. Forel, is placed in this series very near to the line which separates this type from that of the polar lakes, which always have an inverse thermic stratification.

The stratum where the thermic fall is due to the diurnal variation of the temperature of the shallow strata is produced was lower down in 1897 than in 1899. This is well explained by the fact that in 1897 the entire mass of the water of the lake was much warmer than in 1899.

RECENT PAPERS BEARING ON METEOROLOGY.

W. F. R. PHILLIPS, in charge of Library, etc.

The subjoined list of titles has been selected from the contents of the periodicals and serials recently received in the library of the Weather Bureau. The titles selected are of papers or other communications bearing on meteorology or cognate branches of science. This is not a complete index of the meteorological contents of all the journals from which it has been compiled; it shows only the articles that appear to the compiler likely to be of particular interest in connection with the work of the Weather Bureau:

- Annales de Chimie et de Physique. Paris. 7me series. Tome 22.*
 Violle, J. Rapport sur la radiation, présenté au comité météorologique international, à Saint-Petersbourg, en 1899. Pp. 329-370.
Gaea. Leipzig. 37 Jahrg.
 Wolny, E. Ueber den Einfluss der Pflanzendecken auf die Wasserführung der Flüsse. (Schluss). Pp. 220-223.
 Klein, H. J. Strenge Winter. Pp. 223-233.
Annalen der Physik. Leipzig. Vierte folge. Band 4.
 Pockels, F. Zur Theorie der Niederschlagsbildung an Gebirgen. Pp. 459-480.
Himmel und Erde. Berlin. 13 Jahrg.
 Assmann, R. Die modernen Methoden zur Erforschung der Atmosphäre mittels des Luftballons und Drachen. (Schluss folgt). Pp. 241-260.
Nature. London. Vol. 63.
 — Red Rain. Pp. 471-472
 Pellew, E. Variations of Atmospheric Electricity. P. 491.
Symon's Meteorological Magazine. London. Vol. 36.
 Curtis, R. H. Pressure of the Wind. (Concluded). Pp. 17-19.
American Journal of Science. New Haven. 4th series. Vol. 11.
 Penfield, S. L. Stereographic Projection and its Possibilities from a Graphical Standpoint. Pp. 1-24, 115-144.
 Bigelow, Frank H. The Magnetic Theory of the Solar Corona. Pp. 253-262.
Popular Science Monthly. New York. Vol 58.
 Dexter, E. G. Suicide and the Weather. Pp. 604-617.
 Cochrane, C. H. Recent Progress in Aerial Navigation. Pp. 616-624.
Astrophysical Journal. Chicago. Vol. 13.
 Nichols, E. F. On the Heat Radiation of Arcturus, Vega, Jupiter, and Saturn. Pp. 101-141.
Annales de Géographie. Paris. 1901.
 Woelke, A. De l'influence de l'homme sur la terre. (Premier article). P. 97-114.
Zeitschrift für Gewässerkunde. Leipzig. Band 3.
 Wolny, E. Ueber den Einfluss der Pflanzendecken auf die Wasserführung der Flüsse. Pp. 345-362.
Comptes Rendus. Paris. Tome 132.
 Arcowski, Henry. Sur les périodes de l'aurore australes. Pp. 651-654.
La Nature. Paris. 29me année.
 Plumondon, J. R. Le tir au canon contre la grêle. Pp. 266-267.
Meteorologische Zeitschrift. Band 18. Wien.
 Mohn, H. Einige Bemerkungen über die Schwerekorrekturen der Barometerhöhen. P. 49-53.

- Woelke, A. Platzregen und grosse tägliche Regenmengen. Pp. 53-75.
 Schreiber, —. Beiträge zur Hageltheorie. Pp. 58-70.
 — Vorläufige Mittheilung über die internationale Ballonfahrt vom 8 November, 1900. P. 71.
 — Vorläufige Mittheilung über die internationale Ballonfahrt vom 10 Januar, 1901. P. 71.
 Valentin, J. Temperatur-Beobachtungen der österreichischen Ballons bei der internationalen Fahrt vom 8 November, 1900. P. 72.
 Hann, J. Klima der Westküste von Marokko, Mogador. P. 76.
 Lachmann, G. Ueber eine merkwürdige Blitzform. P. 80.
 Kassner, O. Bequeme Berechnung der Koeffizienten der Bes-sel'schen Formel. P. 81.
 Kassner, O. Eine Analogie der irisirenden Wolken.. P. 82.
 — Resultate der meteorologischen Beobachtungen in Belle Isle (Neufundland). P. 83.
 — Zum Klima von Syra. P. 83.
 — Versuche über den Verlust der Ladung elektrischer Flüssigkeiten durch Verdampfung. P. 84.
 Elster, J. Messungen der elektrischen Zerstreuung in der freien atmosphärischen Luft an geographisch weit von einander entfernt liegenden Orten. P. 85.
 Wedell-Wedellsborg, P. S. Notiz über die Ursachen der sekundären Variationen des Erdmagnetismus. P. 88.
 Halm, J. Breitenvariation, Erdmagnetismus und Sonnenthätigkeit. P. 89.
 Taudin-Cabot, J. J. Gröstrahlung. P. 90.
 — Zum Klima des arktischen Nordamerika. P. 90.
 Mac Dowall, Al. B. Säkulare Schwankung? P. 92.
 Chistoni, C. Ueber den Regenfall in Modena 1830-1896. P. 93.
 Prohaska, K. Feuerkugel in Pöllau, Steiermark.
 Hepites, Stefan. Ausserordentlicher Regenfall in Rumänien. P. 94.
 — Druckfehler-Berichtigungen. P. 95.

CLIMATOLOGY OF COSTA RICA.

Communicated by H. PITTIER, Director, Physical Geographic Institute.

TABLE 1.—Hourly observations at the Observatory, San Jose de Costa Rica, during February, 1901.

Hours.	Pressure.		Temperature.		Relative humidity.		Rainfall.		
	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Observed, 1901.	Normal, 1889-1900.	Duration, 1901.
	660+ Mm.	660+ Mm.	° C.	° C.	%	%	Mm.	Mm.	Hrs.
1 a. m.	4.75	4.02	16.33	16.31	78	83	0.0	0.0	0.00
2 a. m.	4.37	3.56	16.31	16.05	81	81	0.0	0.0	0.00
3 a. m.	4.15	3.35	16.04	15.81	81	84	0.0	0.0	0.00
4 a. m.	4.17	3.31	16.17	15.67	80	84	0.0	0.1	0.00
5 a. m.	4.34	3.55	16.00	15.56	80	84	0.0	0.0	0.00
6 a. m.	4.74	3.94	15.51	15.43	84	84	0.0	0.1	0.00
7 a. m.	5.04	4.34	16.36	16.11	80	82	0.0	0.0	0.00
8 a. m.	5.30	4.67	18.65	18.8	66	74	0.0	0.0	0.00
9 a. m.	5.62	4.90	21.18	20.45	57	66	0.0	0.0	0.00
10 a. m.	5.72	4.90	23.41	23.70	53	60	0.0	0.0	0.00
11 a. m.	5.42	4.53	24.94	23.89	49	57	0.0	0.0	0.00
12 m.	4.90	4.08	26.01	24.79	46	55	0.0	0.0	0.00
1 p. m.	4.31	3.57	26.27	25.18	48	54	1.0	0.0	0.33
2 p. m.	3.61	3.01	25.84	24.96	49	55	0.2	0.0	0.33
3 p. m.	3.36	2.58	24.86	24.24	54	58	0.0	0.1	0.00
4 p. m.	3.37	2.58	23.29	23.77	59	60	0.0	0.1	0.00
5 p. m.	3.58	2.76	21.16	21.16	66	68	4.3	0.1	0.67
6 p. m.	3.97	3.13	19.56	19.49	72	74	3.0	0.0	1.00
7 p. m.	4.46	3.65	18.76	18.35	76	79	0.1	0.1	0.08
8 p. m.	4.85	4.10	18.28	17.90	76	80	0.0	0.1	0.06
9 p. m.	5.24	4.44	17.21	17.46	77	81	0.0	0.7	0.00
10 p. m.	5.42	4.63	17.56	17.12	76	82	0.0	0.1	0.00
11 p. m.	5.44	4.61	17.33	16.74	77	83	0.0	0.0	0.00
Midnight	5.19	4.36	16.93	16.51	79	84	0.0	0.0	0.00
Mean	664.63	663.86	19.80	19.27	69	73	.....	.....	.....
Minimum	661.70	659.35	12.30	8.20	25	.....	.....	.....	.....
Maximum	667.70	667.72	31.60	32.00	96	.....	4.3	.....	.....
Total	.....	.....	.....	.....	.....	.....	8.6	1.5	2.41

REMARKS.—The barometer is 1,169 meters above sea level. Readings are corrected for gravity, temperature, and instrumental error. The dry and wet bulb thermometers are 1.5 meters above ground and corrected for instrumental errors. The hourly readings for pressure, wet and dry bulb thermometers, are obtained by means of Richard registering instruments, checked by direct observations every three hours from 7 a. m. to 10 p. m. The hourly rainfall is as given by Hottinger's self-register, checked once a day. The standard rain gage is 1.5 meters above ground.